US009211667B2

(12) **United States Patent**
Kobune et al.

(10) **Patent No.: US 9,211,667 B2**
(45) **Date of Patent: Dec. 15, 2015**

(54) **METHOD AND DEVICE FOR MOLDING SOFT AND THIN RESIN MOLDED PRODUCT**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/420,084**

(22) PCT Filed: **Jul. 23, 2013**

(86) PCT No.: **PCT/JP2013/069951**

§ 371 (c)(1),
(2) Date: **Feb. 6, 2015**

(87) PCT Pub. No.: **WO2014/024680**

PCT Pub. Date: **Feb. 13, 2014**

(65) **Prior Publication Data**

US 2015/0165664 A1 Jun. 18, 2015

(30) **Foreign Application Priority Data**

Aug. 9, 2012 (JP) 2012-176959

(51) **Int. Cl.**

B29C 45/42	(2006.01)
B29C 45/40	(2006.01)
B29C 45/14	(2006.01)

(52) **U.S. Cl.**

CPC ***B29C 45/40*** (2013.01); ***B29C 45/4005*** (2013.01); ***B29C 45/42*** (2013.01); ***B29C 45/4225*** (2013.01); *B29C 45/14811* (2013.01); *B29C 2045/4063* (2013.01)

(58) **Field of Classification Search**

CPC B29C 37/0007; B29C 2045/4063; B29C 2045/4068; B29C 45/42; B29C 45/4225

See application file for complete search history.

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(57) **ABSTRACT**

The present invention relates to a method and a device for molding a soft and thin resin molded product, in which molten resin is injected into a molding space between a concave mold and a convex mold to mold the soft and thin resin molded product. The convex mold or the concave mold is opened while the soft and thin resin molded product is left in the concave mold in such a way as to become open in its concave-shaped portion. Then, at least two chuck tabs formed outside the concave-shaped portion of the soft and thin resin molded product left in the concave mold are each held by a chuck of a molded product removing machine, and the concave-shaped portion of the soft and thin resin molded product is supported by a support arm of the molded product removing machine.

8 Claims, 7 Drawing Sheets

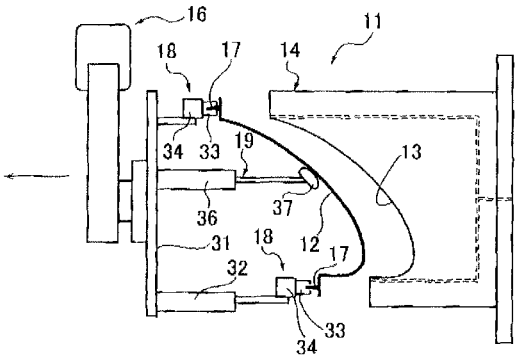

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FIG.1

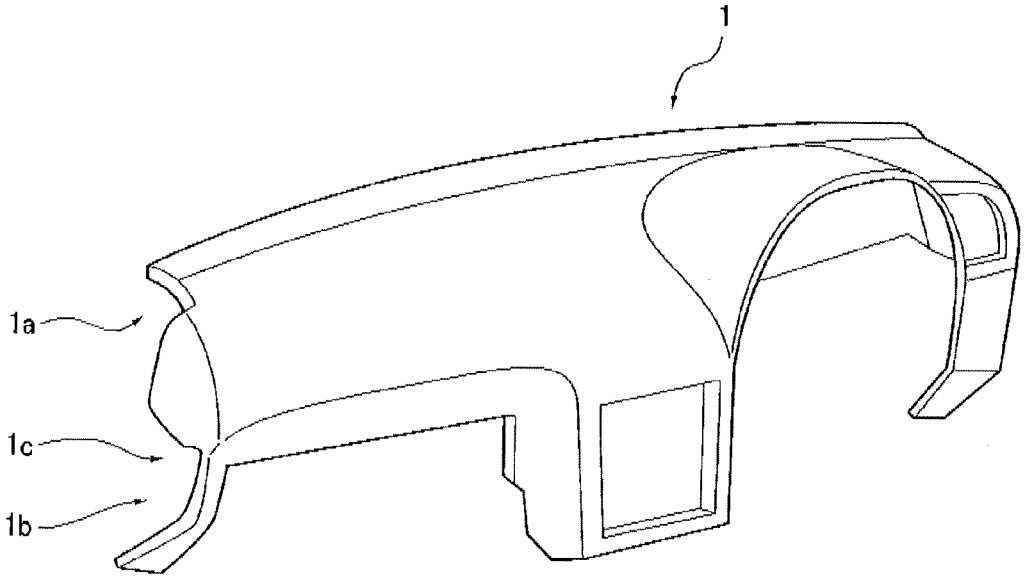


FIG.2

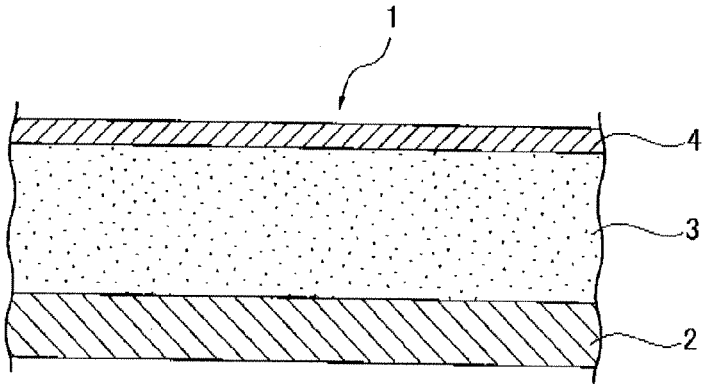


FIG.3

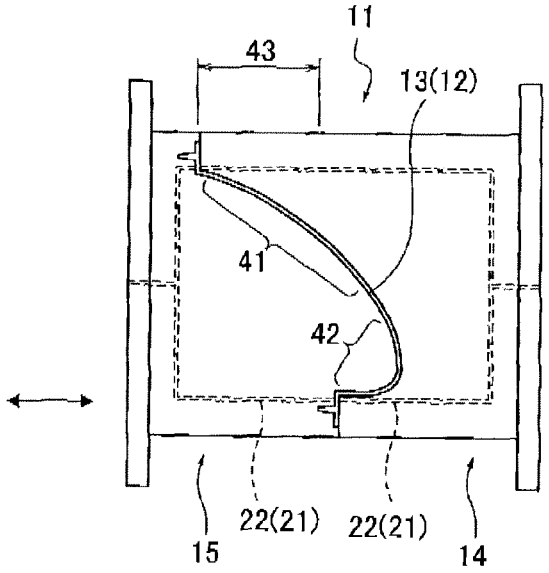


FIG.4

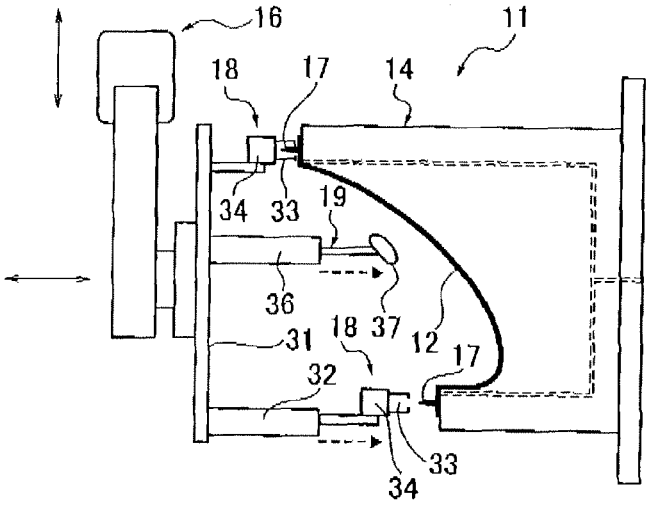


FIG.5

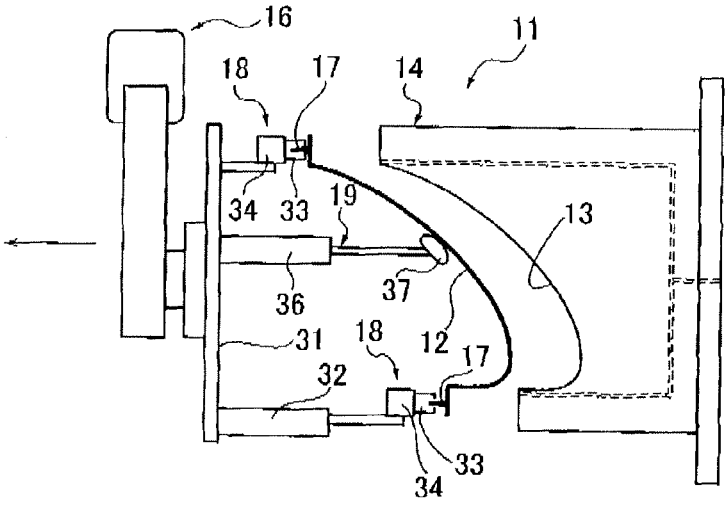


FIG.6A

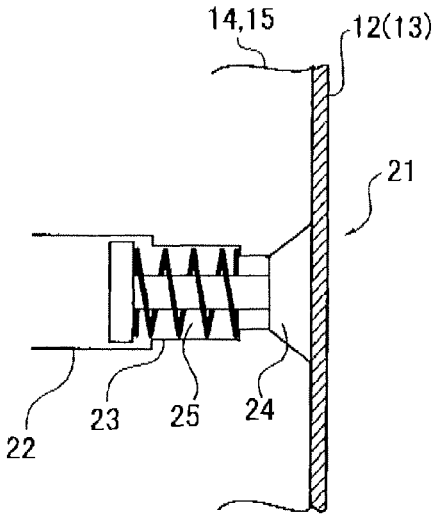


FIG.6B

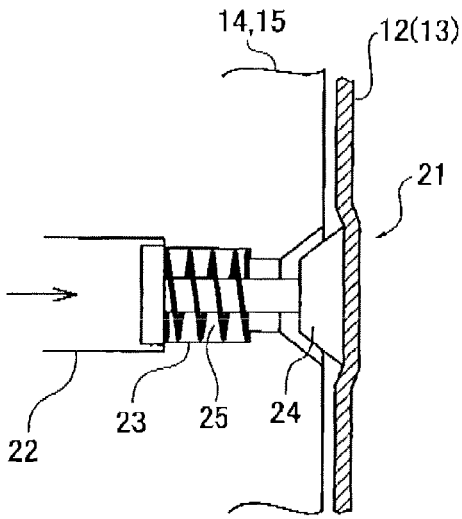


FIG.7A

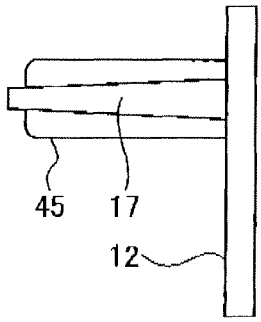


FIG.7B

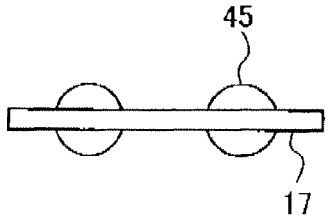


FIG.7C

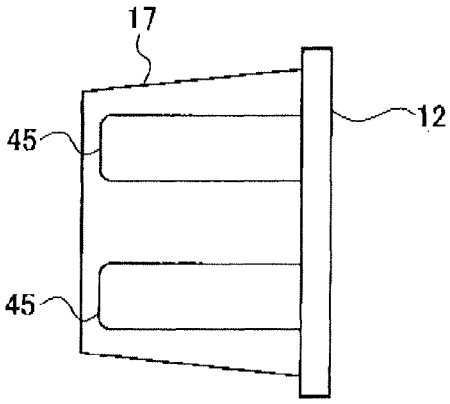


FIG.8

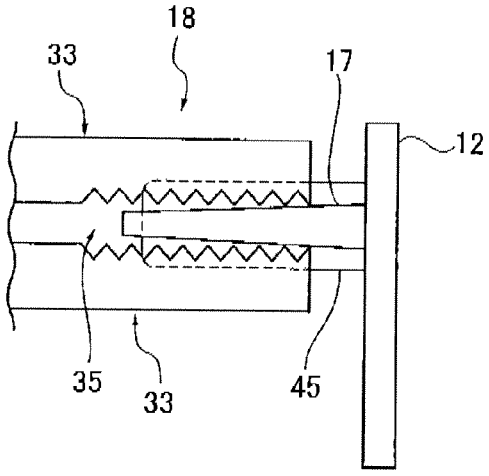


FIG.9

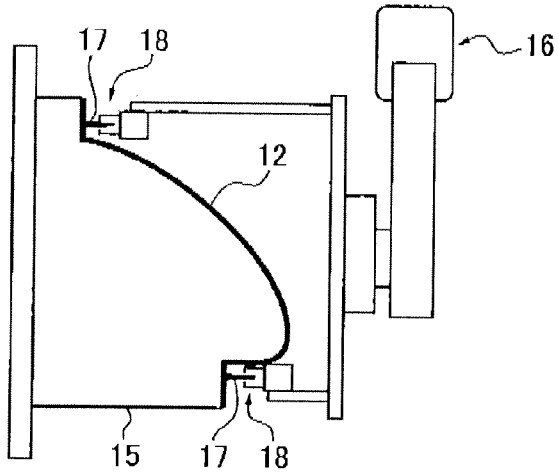


FIG.10

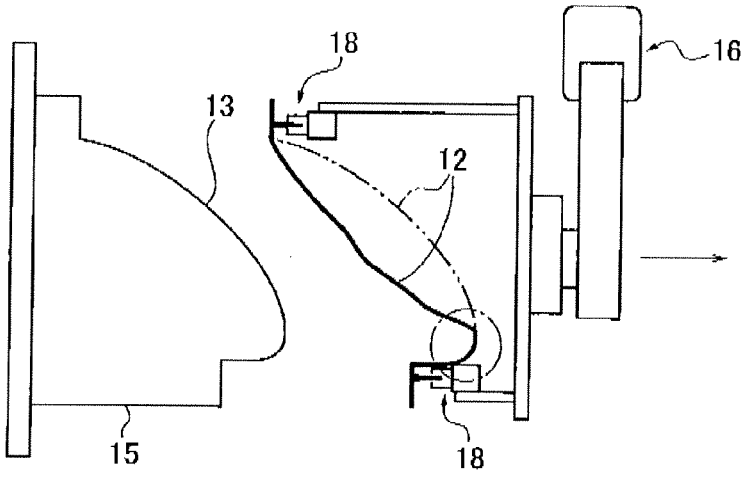


FIG.11

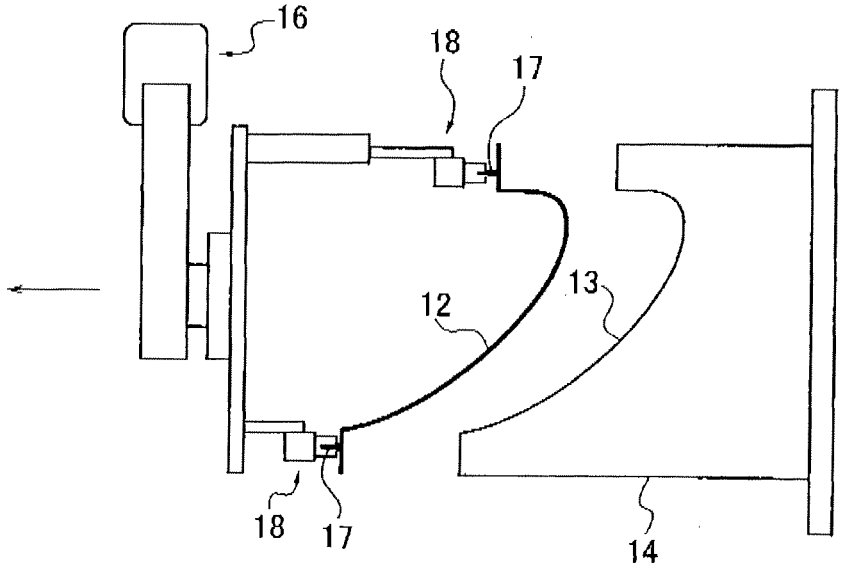


FIG.12

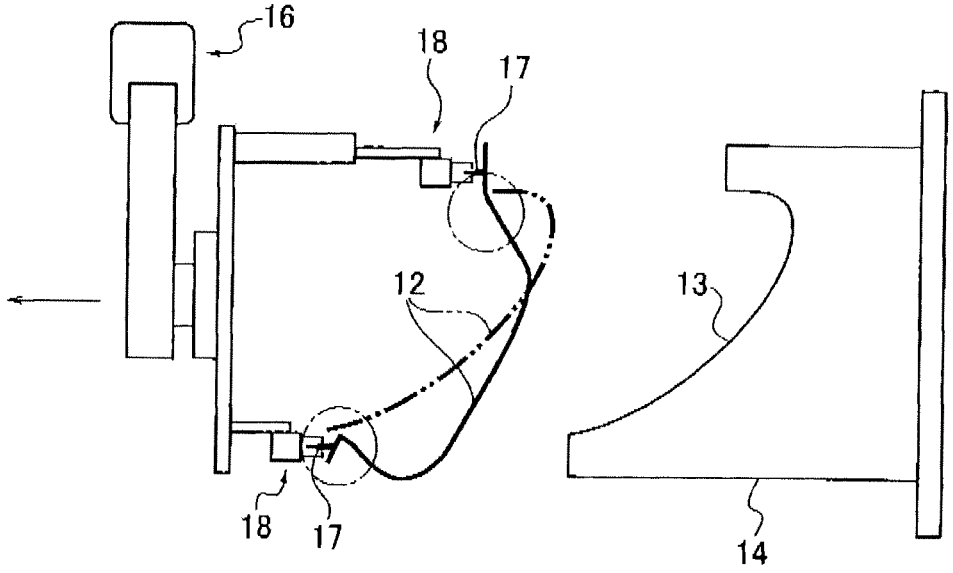


FIG.13A

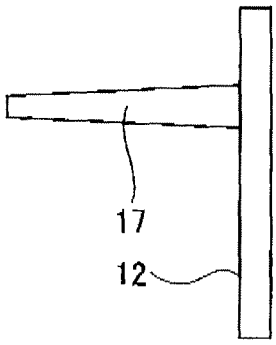


FIG.13B

FIG.13C

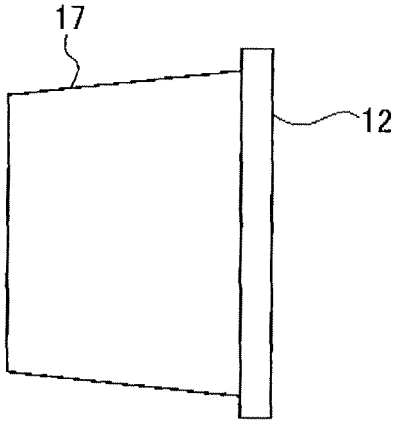


FIG.14A

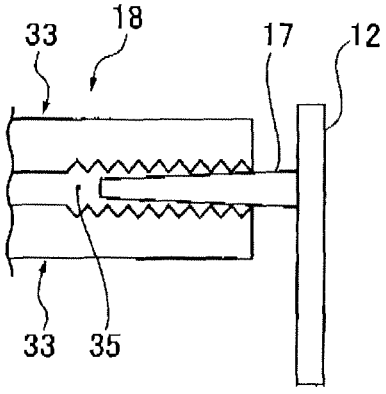


FIG.14B

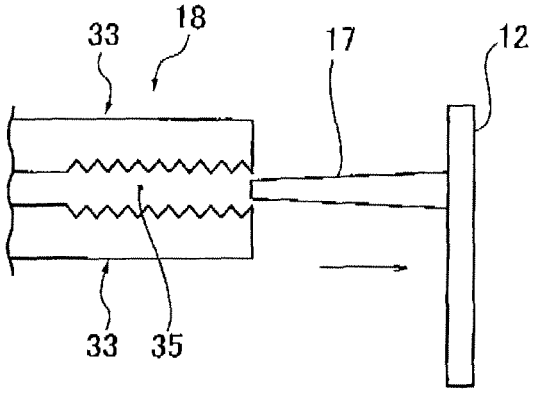
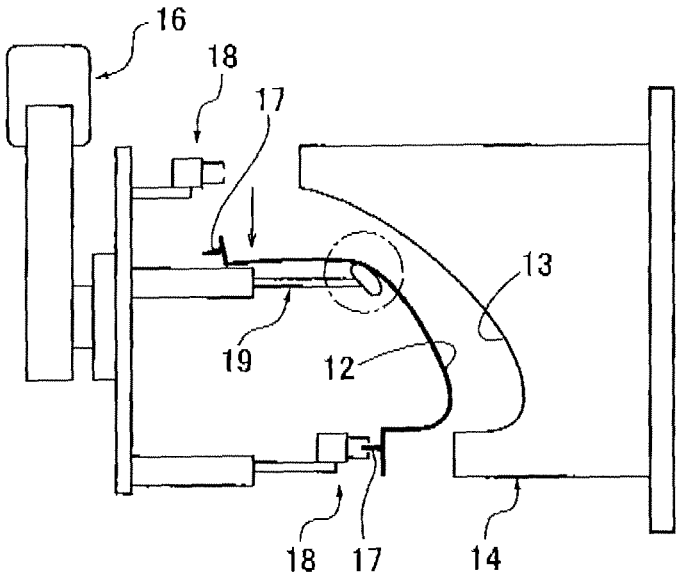


FIG.15



METHOD AND DEVICE FOR MOLDING SOFT AND THIN RESIN MOLDED PRODUCT

TECHNICAL FIELD

The present invention relates to a method and a device for molding a soft and thin resin molded product, enabling the achievement of hitherto difficult automation of demolding of the soft and thin resin molded product.

BACKGROUND ART

A vehicle such as an automobile is provided with a vehicle-cabin front interior panel called an instrument panel or a dashboard or the like, in a vehicle cabin at its front portion.

Some of such vehicle-cabin front interior panels have a multilayer structure formed of a cushion layer and a soft and thin skin material laminated on a surface of a hard core material.

The soft and thin skin material is typically manufactured by powder slush molding, vacuum molding, or the like.

Among these moldings, the powder slush molding, in short, involves melting and adhering resin powder to a heated mold thereby to perform molding, and the vacuum molding, in short, involves bringing a thermally softened thermoplastic resin sheet into intimate contact with a vacuum mold by vacuum suction thereby to form the thermoplastic resin sheet into the shape of the vehicle-cabin front interior panel.

Since such powder slush molding or vacuum molding uses particular facilities, development of a technology for enabling injection molding using general facilities to mold the soft and thin skin material has advanced. (Refer to Patent Literature 1, for example.)

CITATION LIST

Patent Literature

Patent Literature 1: Japanese Patent Application Publication No. 2011-218631

SUMMARY OF INVENTION

Problem to Solution

However, means for manufacturing a soft and thin resin molded product described in Patent Literature 1 has a difficulty in mechanical and automatic demolding and hence requires manual operation for demolding, since the soft and thin resin molded product obtained by molding is very delicate, or equivalently, the soft and thin resin molded product at the time of demolding is extremely soft because of being higher in its temperature than that at normal temperature.

Solution to Problem

In order to solve the foregoing problem, there is provided a method for molding a soft and thin resin molded product, in which molten resin is injected into a molding space formed between a concave mold and a convex mold to mold the soft and thin resin molded product, the method including: opening at least one of the concave mold and the convex mold while the soft and thin resin molded product is left in the concave mold; locking at least two locking tabs formed outside a concave-shaped portion of the soft and thin resin molded product left in the concave mold, by an arm of a molded product removing machine; supporting the concave-shaped portion of the soft and thin resin molded product by a support arm of the molded product removing machine; and demolding the soft and thin resin molded product from the concave mold by separating the molded product removing machine from the concave mold while maintaining the locking and the supporting.

Advantageous Effects of Invention

According to the above-described configuration, an operational advantage as given below can be achieved. Specifically, demolding can be performed under a condition where at least three points, specifically, at least two positions outside the concave-shaped portion of the soft and thin resin molded product, and the concave-shaped portion thereof, are locked by the arm of the molded product removing machine and supported by the support arm thereof. Thus, the soft and thin resin molded product can be successfully demolded without being creased or otherwise poorly shaped. This enables the hitherto difficult mechanization and automation of demolding of the soft and thin resin molded product.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a perspective view of an instrument panel.

FIG. **2** is a partial sectional view of the instrument panel of FIG. **1**.

FIG. **3** is a side view illustrating a closed state of a concave mold and a convex mold in a soft and thin resin molding device according to an embodiment.

FIG. **4** is a side view illustrating a molded product removing machine in the soft and thin resin molding device of FIG. **3**.

FIG. **5** is a view of assistance in explaining operation of FIG. **4**.

FIG. **6**A is an enlarged partial sectional view illustrating an air ejector provided in each of the concave mold and the convex mold of FIG. **3**, illustrating a state before the operation.

FIG. **6**B is an enlarged partial sectional view illustrating the air ejector provided in each of the concave mold and the convex mold of FIG. **3**, illustrating a state after the operation.

FIG. **7**A is a side view illustrating a chuck tab of FIG. **4**.

FIG. **7**B is a front view illustrating the chuck tab of FIG. **4**.

FIG. **7**C is a plan view illustrating the chuck tab of FIG. **4**.

FIG. **8** is an enlarged view of a chuck piece portion of FIG. **4**.

FIG. **9** is a view illustrating a state in which the concave mold is opened while a soft and thin resin molded product is left in the convex mold in such a way as to become open at its product top surface side.

FIG. **10** is a view illustrating a demolded state of FIG. **9**.

FIG. **11** is a view illustrating a state in which a molding space is configured to protrude outward in a mold-withdrawing direction by a larger amount of protrusion in a lower edge portion than that in an upper edge portion.

FIG. **12** is a view illustrating a demolded state of FIG. **11**.

FIG. **13**A is a side view illustrating the chuck tab which is not provided with a come-off preventive shape portion.

FIG. **13**B is a front view illustrating the chuck tab which is not provided with the come-off preventive shape portion.

FIG. **13**C is a plan view illustrating the chuck tab which is not provided with the come-off preventive shape portion.

FIG. **14**A is an enlarged view of the chuck piece portion of FIG. **4** holding the chuck tab of FIG. **13**A.

FIG. **14**B is a view illustrating a state in which the chuck tab of FIG. **13**A has come off from chuck pieces.

FIG. **15** is a view illustrating a demolded state in a case of the chuck tab which is not provided with the come-off preventive shape portion.

DESCRIPTION OF EMBODIMENTS

Specific examples of embodiments will be described in detail below with reference to the drawings.

FIGS. **1** to **15** are of assistance in explaining examples and modifications thereof.

A vehicle such as an automobile is provided with a vehicle-cabin front interior panel called an instrument panel **1** as illustrated in FIG. **1** or a dashboard or the like (hereinafter called the instrument panel **1**), in a vehicle cabin at its front portion.

Some of such instrument panels **1** have a multilayer structure formed of a cushion layer **3** (or a foamed layer) and a soft and thin (or equivalently, extremely soft and extremely thin) skin material **4** laminated on a surface of a hard core material **2**, as illustrated in FIG. **2**.

The present invention relates to a method and a device for molding a soft and thin resin molded product, which can be used for molding the soft and thin skin material **4** as described above, for example.

EXAMPLES

Configurations

Configurations will be described below.

Firstly, a "soft and thin resin molding device" will be described.

[Configuration 1]

As illustrated in FIG. **3**, a soft and thin resin molding device **11** includes a concave mold **14** and a convex mold **15** having a molding space **13** for molding (or injection molding) a soft and thin resin molded product **12**.

As illustrated in FIGS. **4** and **5**, the soft and thin resin molding device **11** also includes a molded product removing machine **16** for demolding the soft and thin resin molded product **12** formed in the molding space **13**, from the concave mold **14**.

Also, the molded product removing machine **16** includes an arm (for example, a chuck **18** for holding chuck tabs **17**) for locking at least two locking tabs (for example, plural chuck tabs **17**) formed outside (for example, in upper and lower edge portions of) a concave-shaped portion of the soft and thin resin molded product **12** (for example, a product underside) left in the concave mold **14** so as to become open by opening at least one of the convex mold **15** and the concave mold **14**, and a support arm **19** for supporting the concave-shaped portion of the soft and thin resin molded product **12** (for example, a vertically intermediate portion on the product underside).

Also, the molded product removing machine **16** is configured to be separable from the concave mold **14** (or move away from therefrom).

[Supplementary Explanation 1]

Here, the "soft and thin resin molded product **12**" has a complicated shape and a large size (or a large area), for example having a width of about 1.4 to 2 m, a height of about 60 to 90 cm and a depth of about 40 to 90 cm in a vehicle longitudinal direction, in a case of, for example, the skin material **4** of the instrument panel **1** of FIGS. **1** and **2**. Meanwhile, a thickness of the skin material **4** of the instrument panel **1** is as extremely small as about 1.0 to 2.0 mm and the skin material **4** is soft. Also, the instrument panel **1** (or the skin material **4** thereof), as seen in a side view, has substantially a curved shape having a top surface portion **1***a* facing at least upward, a rear surface portion **1***b* facing toward an occupant, and a bent portion **1***c* interposed between the top surface portion **1***a* and the rear surface portion **1***b*. Also, a convex surface side (or a convex-shaped portion) of the curved shape forms a product top surface, and a concave surface side (or a concave-shaped portion) of the curved shape forms the product underside.

The "molding space **13**" is formed between the concave mold **14** and the convex mold **15**, as illustrated in FIG. **3**. As described above, the molding space **13** for molding the soft and thin resin molded product **12** is formed of an extremely narrow gap (of about 1.0 to 2.0 mm). Therefore, molten resin having very high fluidity is injected into the extremely narrow molding space **13** so that the molten resin can spread in every corner.

The "concave mold **14**" forms the product top surface of the soft and thin resin molded product **12**. The concave mold **14** is configured as a concave fixed mold, for example. However, the concave mold **14** may be configured as a concave movable mold. A decorative pattern, such as a grain pattern, for decoration of the product top surface is formed in the molding space **13** on the concave mold **14** side, as needed. Also, the concave mold **14** is provided with an air ejector **21** as illustrated in FIGS. **6**A and **6**B.

The air ejector **21** causes the soft and thin resin molded product **12** to float over the concave mold **14** by an air pressure. The air ejector **21** includes an air passage **22** provided within the concave mold **14** so as to provide communication between the inside and outside of the molding space **13**, a movable valve element **24** housed and installed in a valve housing space **23** provided in an opening portion of the air passage **22** on the molding space **13** side thereof, in such a manner that the movable valve element **24** can enter and exit the valve housing space **23**, and a return spring **25** (a return elastic member, a pulling spring) which biases the movable valve element **24** in a direction in which the movable valve element **24** is housed within the valve housing space **23**.

The movable valve element **24** includes a cylindrical shaft portion provided integrally with a fan-shaped conical valve portion. Correspondingly, the valve housing space **23** also includes a cylindrical space having a larger diameter than that of the shaft portion, and a conical space having the same size and shape as those of the valve portion.

The plural air ejectors **21** are provided at a position outward of a portion of the soft and thin resin molded product **12** to form the product, at a position to form an opening or the like of the soft and thin resin molded product **12**, or equivalently, at a position to be cut off from the product by a process to be performed later, and at other positions.

The "convex mold **15**" forms the product underside of the soft and thin resin molded product **12**. The convex mold **15** is configured as a convex movable mold, for example. However, the convex mold **15** may be configured as a convex fixed mold. The convex mold **15** is provided with the air ejector **21** as illustrated in FIGS. **6**A and **6**B in the same manner as above described. Since the air ejector **21** of the convex mold **15** is the same as the air ejector **21** of the concave mold **14**, description thereof will be omitted by replacing the concave mold **14** in the above description by the convex mold **15**.

The "molded product removing machine **16**" is insertable between the opened concave and convex molds **14**, **15**, as illustrated in FIGS. **4** and **5**. Alternatively, the molded product removing machine **16** is configured to be capable of facing the opened molding space **13** of the concave mold **14** after the opening of the convex mold **15**. In this case, an industrial

robot, for example, is mainly used as the molded product removing machine **16**. Preferably, the industrial robot is of a three-axes type which is movable at least in directions of three axes orthogonal to one another, or is of a three- or more-axes type. A direction of separation (or separable movement) of the molded product removing machine **16** from the concave mold **14** is the same as a direction of demolding of the soft and thin resin molded product **12**, or a mold-withdrawing direction of the convex mold **15**, or the like. Of course, the molded product removing machine **16** can move into close proximity to the concave mold **14**.

The "locking tab" or the "chuck tab **17**" is integrally molded with the soft and thin resin molded product **12** in a portion of the soft and thin resin molded product **12** outward of the portion thereof to form the product, as illustrated in FIGS. **7**A, **7**B and **7**C. The chuck tab **17** is basically formed in substantially the same wall thickness as that of the soft and thin resin molded product **12** (or equivalently, is extremely thin-walled). However, the chuck tab **17** may also have a tapered shape so as to facilitate withdrawing the mold. In this case, the chuck tabs **17** are provided at plural locations at least on an outer side of the soft and thin resin molded product **12**, for example, in the upper and lower edge portions thereof. The chuck tab **17** is for example in the form of a tongue having a width on the order of 3 to 5 cm, a length on the order of 2 to 4 cm, and a thickness on the order of about 1.0 to 2.0 mm, or in the like form. However, the size of the chuck tab **17** is not so limited. In the above figures, the chuck tab **17** has a substantially trapezoidal shape with an upper base on its leading end side and a lower base on the soft and thin resin molded product **12** side so as to be resistant to tearing. The chuck tab **17** is cut off and removed from the soft and thin resin molded product **12** at an appropriate time after demolding.

The "arm of the molded product removing machine **16**" or the "chuck **18**" is installed directly, or indirectly through a movable cylinder **32**, on a base plate **31** mounted to the industrial robot which forms the molded product removing machine **16**, as illustrated in FIGS. **4**, **5** and **8**. The movable cylinder **32** can move into close proximity to the chuck tab **17** and move away therefrom. In this case, the molding space **13** has a shape as later described, and thus, the chuck **18** on the upper edge portion side is installed directly on the base plate **31**, and the chuck **18** on the lower edge portion side is installed indirectly through the movable cylinder **32** on the base plate **31**. However, the movable cylinders **32** may also be provided on both the upper and lower chucks **18**. Also, the provision of the movable cylinder **32** is not necessary, depending on circumstances.

The chuck **18** includes a pair of chuck pieces **33** (see FIG. **8**) capable of sandwiching the chuck tab **17** therebetween, and a chuck cylinder **34** (see FIG. **4**, although not specifically illustrated) capable of opening and closing the pair of chuck pieces **33**. Biting portions **35** having a concave-convex shape are formed on facing surfaces (or sandwiching surfaces) of the pair of chuck pieces **33**. The chucks **18** are provided in number corresponding to the number of the chuck tabs **17**. Alternatively, the chuck **18** may be configured to be capable of simultaneously sandwiching and holding the plural chuck tabs **17**, thereby to reduce the number of the chucks **18** installed.

As illustrated in FIGS. **4** and **5**, the "support arm **19**" includes a movable cylinder **36** installed on the base plate **31**, and a support member **37** mounted to a leading end portion of the movable cylinder **36**. The movable cylinder **36** holds the support member **37** so as to be capable of moving into close proximity to the soft and thin resin molded product **12** and separably moving away therefrom. The support member **37** may be configured for example in the form of a bar extending perpendicularly to the sheet as seen in the drawing. The support member **37** may have an inclined surface provided at its leading end side and capable of supporting the soft and thin resin molded product **12** on its lower side (just like lifting up it). In this case, the inclined surface of the support member **37** on the leading end side thereof has an upward slope to the left in the drawing, substantially along an inclined shape of the soft and thin resin molded product **12** on the product underside thereof. The support member **37** is wholly rounded in order to prevent it from causing damage such as a flaw to the soft and thin resin molded product **12**, and is considered so as not to come in point or line contact with the soft and thin resin molded product **12** or do the like. The plural support arms **19** may be installed vertically, perpendicularly to the sheet as seen in the drawing, or in other directions.

In a case of the single support arm **19**, preferably, the position of the vertically intermediate portion of the soft and thin resin molded product **12** supported by the support arm **19** is set to establish at least one of a position around a vertically intermediate position, a position around a center position in the mold-withdrawing direction (horizontally in FIG. **4**), and a position around the position of center of gravity of the soft and thin resin molded product **12**. However, all these positions do not coincide with one another and the positions also vary depending on a specific shape of the soft and thin resin molded product **12**, and thus, a specific (or an optimum) support position is set by utilizing trials and errors or the like. In a case of the provision of the plural support arms **19**, the optimum support position may be chosen as appropriate according to circumstances.

In the above-described embodiment, the convex mold **15** (or the convex movable mold) and the concave mold **14** (or the concave fixed mold) are configured to leave the soft and thin resin molded product **12** in the concave mold **14** (or the concave fixed mold); however, in another embodiment, the convex mold **15** (or the convex fixed mold) and the concave mold **14** (or the concave movable mold) may be configured to leave the soft and thin resin molded product **12** in the concave mold **14** (or the concave movable mold).

[Configuration 2]

As illustrated in FIG. **3**, the molding space **13** is configured to have a curved shape having a smaller radius of curvature at its lower side than that at its upper side.

[Supplementary Explanation 2]

For example, the "molding space **13**" includes a curvedly shaped portion **41** having a relatively large radius of curvature at its upper side, and a curvedly shaped portion **42** having a relatively small radius of curvature at its lower side.

[Configuration 3]

The molding space **13** is configured to protrude outward in the mold-withdrawing direction by a larger amount of protrusion in the upper edge portion than that in the lower edge portion (the amount of outward protrusion **43**).

[Supplementary Explanation 3]

For example, the "molding space **13**" protrudes toward the convex mold **15** by a considerably larger amount of protrusion in the upper edge portion than that in the lower edge portion. As illustrated in FIG. **5**, the position of the lower edge portion of the molding space **13** substantially coincides vertically with the position of the vertically intermediate portion of the soft and thin resin molded product **12** supported by the support arm **19**.

[Configuration 4]

As illustrated in FIGS. **7**A, **7**B and **7**C, the chuck tab **17** is provided with a come-off preventive shape portion **45** for preventing the chuck tab **17** from coming off from the chuck **18**.

[Configuration 5]

The "come-off preventive shape portion **45**" may be configured as a partial thick-walled portion or the like provided on the chuck tab **17**. In this case, the come-off preventive shape portion **45** is configured as a cylindrical thick-walled portion provided on the chuck tab **17**. The cylindrical thick-walled portion extends in the mold-withdrawing direction.

The two cylindrical thick-walled portions are disposed substantially parallel to each other. However, the shape and installed position of the come-off preventive shape portion **45**, the number of the come-off preventive shape portions **45** installed, the installed direction of the come-off preventive shape portion **45**, and the like are not so limited. For example, the number of the thick-walled portions installed may be set to one or three or more. Also, the installed direction of the thick-walled portion may extend in a direction orthogonal to the mold-withdrawing direction. The thick-walled portion may have a spot-like shape or the like shape.

Next, description will be given with regard to a "method for molding the soft and thin resin molded product **12**" using the soft and thin resin molding device **11**.

[Configuration 6]

In the method for molding the soft and thin resin molded product **12**, first, molten resin is injected into the molding space **13** formed between the concave mold **14** and the convex mold **15** to mold (or injection mold) the soft and thin resin molded product **12** (a molding process).

Then, at least one of the concave mold **14** and the convex mold **15** is opened while the soft and thin resin molded product **12** is left in the concave mold **14**. For example, the convex mold **15** is opened while the soft and thin resin molded product **12** is left in the concave mold **14** in such a way as to become open at the product underside thereof (a mold opening process).

Further, as illustrated in FIG. **4**, the at least two locking tabs formed outside the concave-shaped portion of the soft and thin resin molded product **12** left in the concave mold **14** are each locked by the arm of the molded product removing machine **16**, and the concave-shaped portion of the soft and thin resin molded product **12** is supported by the support arm **19** provided in the molded product removing machine **16**. For example, the plural chuck tabs **17** formed in the upper and lower edge portions of the soft and thin resin molded product **12** left in the concave mold **14** are each held by the chuck **18** provided in the molded product removing machine **16**, and the concave-shaped, vertically intermediate portion of the soft and thin resin molded product **12** on the product underside thereof is supported by the support arm **19** provided in the molded product removing machine **16** (a soft and thin resin molded product supporting process).

Finally, as illustrated in FIG. **5**, the arm of the molded product removing machine **16** is separated from the concave mold **14** to demold the soft and thin resin molded product **12** from the concave mold **14**. For example, the soft and thin resin molded product **12** is demolded from the concave mold **14** by separating (or separably moving) the molded product removing machine **16** from the concave mold **14** while maintaining the above-described condition (specifically, a condition where the chuck tabs **17** are each held by the chuck **18**, and the vertically intermediate portion of the soft and thin resin molded product **12** is supported by the support arm **19**) (a demolding process).

[Supplementary Explanation 6]

Although not particularly illustrated, a well-known means may be used to inject the molten resin into the molding space **13**.

When opening the convex mold **15**, the air ejector **21** as illustrated in FIGS. **6**A and **6**B is used to cause the soft and thin resin molded product **12** to at least partially float over the convex mold **15** by an air pressure.

Also, when the molded product removing machine **16** demolds the soft and thin resin molded product **12** from the concave mold **14**, the air ejector **21** is used in advance to cause the soft and thin resin molded product **12** to at least partially float over the concave mold **14** by the air pressure. In this case, the air ejector **21** causes the movable valve element **24** to protrude by the air pressure thereby to extrude partially the soft and thin resin molded product **12**, and also injects air between an extruded portion of the soft and thin resin molded product **12** and the convex mold **15** or the concave mold **14** thereby to cause the soft and thin resin molded product **12** to float over the convex mold **15** or the concave mold **14**. Note that the air ejector **21** causes the soft and thin resin molded product **12** to float over the concave mold **14** after the opening of the convex mold **15** has been finished.

Advantageous Effects

According to the embodiment, operational advantages as given below can be achieved.

[Operational Advantage 1]

Demolding can be performed under, a condition where at least three points, specifically, at least two positions (for example, the upper and lower edge portions) outside the concave-shaped portion of the soft and thin resin molded product **12**, and the concave-shaped portion (for example, the vertically intermediate portion) of the soft and thin resin molded product **12**, are held by the arm (for example, the chuck **18**) of the molded product removing machine **16** and supported by the support arm **19** thereof. Thus, the soft and thin resin molded product **12** can be successfully demolded without being creased or otherwise poorly shaped. This enables the hitherto difficult mechanization and automation of demolding of the soft and thin resin molded product **12**.

In this case, at least one of the convex mold **15** and the concave mold **14** is opened while the soft and thin resin molded product **12** is left in the concave mold **14** in such a way as to become open in the concave-shaped portion thereof (for example, at the product underside thereof). Thereby, as illustrated in FIGS. **4** and **5**, the concave-shaped soft and thin resin molded product **12** (or the vertically intermediate portion thereof on the product underside) can be supported by the support arm **19**. Thus, during demolding, for example, the soft and thin resin molded product **12** can be prevented from hanging down under its own weight in the vertically intermediate portion thereof and thus being creased or otherwise poorly shaped.

On the other hand, as illustrated in FIGS. **9** and **10**, if the concave mold **14** is opened while the soft and thin resin molded product **12** is left in the convex mold **15** in such a way as to become open at the product top surface side thereof, the concave-shaped soft and thin resin molded product **12** (or the vertically intermediate portion thereof on the product top surface side) cannot be supported by the support arm **19** (just like lifting up it on the lower side). Thus, during demolding, the soft and thin resin molded product **12** cannot avoid hanging down under its own weight in the vertically intermediate portion thereof and thus being creased or otherwise poorly shaped (See a circled portion in FIG. **10**, in particular.)

[Operational Advantage 2]

The molding space **13** is configured to have the curved shape having a smaller radius of curvature at its lower side than that at its upper side. Thereby, as illustrated in FIGS. **4** and **5**, the soft and thin resin molded product **12** molded in the molding space **13** has a portion at its upper side, which has a large radius of curvature and is relatively prone to deformation, and has a portion at its lower side, which has a small radius of curvature and is relatively resistant to deformation, and thus, the upper, relatively deformation-prone portion of the soft and thin resin molded product **12** can be properly supported by the support arm **19**. Therefore, the soft and thin resin molded product **12** can be successfully demolded from the concave mold **14**.

On the other hand, contrary to the above, if the molding space **13** is configured to have a curved shape having a smaller radius of curvature at its upper side than that at its lower side, the molded soft and thin resin molded product **12**, although not particularly illustrated, has a portion at its upper side, which has a small radius of curvature and is relatively resistant to deformation, and has a portion at its lower side, which has a large radius of curvature and is relatively prone to deformation, and thus, the support arm **19** supports the upper, relatively deformation-resistant portion of the soft and thin resin molded product **12** and cannot properly support the lower, relatively deformation-prone portion thereof. Therefore, it is difficult to successfully demold the soft and thin resin molded product **12** from the concave mold **14**.

[Operational Advantage 3]

The molding space **13** is configured to protrude outward in the mold-withdrawing direction by a larger amount of protrusion in the upper edge portion than that in the lower edge portion. Thereby, as illustrated in FIGS. **4** and **5**, the soft and thin resin molded product **12** molded in the molding space **13** has the upper portion located forward of a support point of the support arm **19**, and thus, the support arm **19** can support the upper portion of the soft and thin resin molded product **12** with reliability. Therefore, the soft and thin resin molded product **12** can be successfully demolded from the concave mold **14**.

On the other hand, contrary to the above, as illustrated in FIGS. **11** and **12**, if the molding space **13** is configured to protrude outward in the mold-withdrawing direction by a larger amount of protrusion in the lower edge portion than that in the upper edge portion, the molded soft and thin resin molded product **12** has the upper portion having a shape of back draft which is the reverse of that illustrated in FIG. **4** and renders it difficult for the support arm **19** to support the upper portion, and thus, it is difficult for the support arm **19** to successfully support the upper portion of the soft and thin resin molded product **12**. Therefore, a situation (i.e. poor demolding) arises where it is difficult to successfully demold the soft and thin resin molded product **12** from the concave mold **14** and hence the soft and thin resin molded product **12** hangs down under its own weight and is thus creased or otherwise poorly shaped (See circled portions in FIG. **12**, in particular)

[Operational Advantage 4]

As illustrated in FIGS. **7**A, **7**B and **7**C, the chuck tab **17** is provided with the come-off preventive shape portion **45** for preventing the chuck tab **17** from coming off from the chuck **18**. Thereby, as illustrated in FIG. **8**, the chuck **18** can reliably hold the chuck tab **17** having substantially the same wall thickness as that of the soft and thin resin molded product **12** (or equivalently, which is thin-walled), and thus, the come-off preventive shape portion **45** can prevent the soft and thin resin molded product **12** from corning off from the chuck **18**. This enables demolding under a condition where the chuck **18** holds the chuck tab **17** with reliability, and thus enables preventing the soft and thin resin molded product **12** from being creased or otherwise poorly shaped. Also, although a large peeling force acts on the chuck **18** when the soft and thin resin molded product **12** is demolded from the concave mold **14**, the provision of the come-off preventive shape portion **45** enables the chuck **18** to accommodate the peeling force with reliability.

On the other hand, contrary to the above, if the chuck tab **17** having the same wall thickness as that of the soft and thin resin molded product **12** (or equivalently, which is thin-walled) is not provided with the come-off preventive shape portion **45** as illustrated in FIGS. **13**A, **13**B and **13**C, the chuck tab **17** slips off and comes off from the chuck **18** when demolding is in process of being performed, as illustrated in FIGS. **14**A and **14**B. Then, as illustrated in FIG. **15**, in a portion in which the chuck tab **17** has come off from the chuck **18**, a situation (i.e. poor demolding) arises where the soft and thin resin molded product **12** hangs down under its own weight and is thus creased or otherwise poorly shaped. (See a circled portion in FIG. **15**, in particular.)

Further, when the come-off preventive shape portion **45** is configured as the partial thick-walled portion as described above, this is an optimum configuration since it can increase rigidity of the chuck tab **17** to thus render the chuck tab **17** resistant to deformation and also make it easy for the chuck **18** to hold the chuck tab **17**.

In addition, although not particularly illustrated, the provision of the come-off preventive shape portion **45** can reduce a time for cooling in the mold as compared to a case where the overall sheet thickness of the chuck tab **17** is simply increased, and thus can eliminate a situation where, when peeling is in process of being performed, the chuck tab **17** is torn off due to poor solidification caused by insufficient cooling of the chuck tab **17**.

On the other hand, if the overall sheet thickness of the chuck tab **17** is simply increased, this leads to a long time for cooling the chuck tab **17** in the mold and also tends to bring about the situation where, when the peeling is in process of being performed, the chuck tab **17** is torn off due to the poor solidification caused by the insufficient cooling of the chuck tab **17**.

[Operational Advantage 5]

The come-off preventive shape portion **45** is formed of the cylindrical thick-walled portion, and the cylindrical thick-walled portion extends in the mold-withdrawing direction. Thereby, during molding, the mold can be withdrawn without any trouble, and also, during demolding, the chuck **18** can hold the chuck tab **17** without any trouble.

Although the embodiments of the present invention have been described in detail above with reference to the drawings, it is to be understood that the embodiments are exemplary only of the present invention, and therefore the present invention is not limited only to the configurations of the embodiments, and design modifications and the like, even if made hereto without departing from the spirit and scope of the invention, of course, are included in the present invention. Of course, it will also be understood that, for example if each embodiment includes plural configurations, possible combinations of the configurations are included in the present invention even if not specified. Of course, it will also be understood that, if plural embodiments and modifications are given, possible ones of combinations of configurations throughout the embodiments and modifications are included in the present invention even if not specified. Of course, it will also be understood that the configurations depicted in the

drawings are included in the present invention even if not specified. Further, the term "or (and) the like" is used to be construed as including the like thing. Moreover, the terms "substantially," "about" and "on the order of" and the like terms are used to be construed as including a thing having a permissible range or accuracy in view of common general knowledge.

INDUSTRIAL APPLICABILITY

The above-described embodiments of the present invention can be used in the skin material **4** of the instrument panel **1** in the vehicle such as the automobile; however, if a product having a large area and a complicated shape like the skin material **4** of the instrument panel **1** can be molded, the present invention can be widely applied to other products. For example, the present invention can be applied to molding of an interior panel other than the instrument panel **1** of the vehicle or the soft and thin resin molded product **12** for use in fields other than the vehicle.

REFERENCE SIGNS LIST

11 soft and thin resin molding device
12 soft and thin resin molded product
13 molding space
14 concave mold (concave fixed mold or concave movable mold)
15 convex mold (convex movable mold or convex fixed mold)
16 molded product removing machine
17 chuck tab (locking tab)
18 chuck (arm of molded product removing machine)
19 support arm
33 chuck piece
34 chuck cylinder
41 curvedly shaped portion
42 curvedly shaped portion
43 amount of outward protrusion
45 come-off preventive shape portion

CROSS-REFERENCE TO RELATED APPLICATION

This application is based upon and claims the benefit of priority of the prior Japanese Patent Application No. 2012-176959, filed on Aug. 9, 2012, the entire contents of which are incorporated herein by reference.

The invention claimed is:

1. A method for molding a soft and thin resin molded product, in which molten resin is injected into a molding space formed between a concave mold and a convex mold to mold the soft and thin resin molded product, the method comprising:

opening at least one of the concave mold and the convex mold while the soft and thin resin molded product is left in the concave mold;

locking at least two locking tabs formed outside a concave-shaped portion of the soft and thin resin molded product left in the concave mold, by an arm of a molded product removing machine;

supporting the concave-shaped portion of the soft and thin resin molded product by a support arm of the molded product removing machine; and

demolding the soft and thin resin molded product from the concave mold by separating the molded product removing machine from the concave mold while maintaining the locking and the supporting.

2. The method for molding a soft and thin resin molded product, according to claim **1**, in which molten resin is injected into a molding space formed between a concave fixed mold and a convex movable mold to injection mold the soft and thin resin molded product, the method comprising:

opening the convex movable mold while the soft and thin resin molded product is left in the concave fixed mold in such a way as to become open at its product underside;

holding at least two chuck tabs formed in upper and lower edge portions of the soft and thin resin molded product left in the concave fixed mold, by a chuck provided in a molded product removing machine;

supporting a concave-shaped, vertically intermediate portion of the soft and thin resin molded product on the product underside thereof by a support arm provided in the molded product removing machine; and

demolding the soft and thin resin molded product from the concave fixed mold by separably moving the molded product removing machine away from the concave fixed mold while maintaining the holding and the supporting.

3. A soft and thin resin molding device comprising:

a concave mold and a convex mold having a molding space for molding a soft and thin resin molded product; and

a molded product removing machine configured to demold the soft and thin resin molded product formed in the molding space,

wherein the molded product removing machine comprises:

an arm configured to lock at least two locking tabs formed outside a concave-shaped portion of the soft and thin resin molded product left in the concave mold by opening at least one of the concave mold and the convex mold; and

a support arm configured to support the concave-shaped portion of the soft and thin resin molded product, and

wherein the arm is configured to be separable from the concave mold.

4. The soft and thin resin molding device according to claim **3** comprising:

a concave fixed mold and a convex movable mold having a molding space for injection molding a soft and thin resin molded product; and

a molded product removing machine configured to demold the soft and thin resin molded product formed in the molding space,

wherein the molded product removing machine comprises:

a chuck configured to hold at least two chuck tabs formed in upper and lower edge portions of the soft and thin resin molded product left in the concave fixed mold in such a way as to become open at its product underside by opening the convex movable mold; and

a support arm configured to support a vertically intermediate portion of the soft and thin resin molded product on the product underside thereof, and

wherein the molded product removing machine is configured to move away from the concave fixed mold.

5. The soft and thin resin molding device according to claim **3**, wherein the molding space is configured to have a curved shape having a smaller radius of curvature at its lower side than that at its upper side.

6. The soft and thin resin molding device according to claim **3**, wherein the molding space is configured to protrude outward in a mold-withdrawing direction by a larger amount of protrusion in the upper edge portion than that in the lower edge portion.

7. The soft and thin resin molding device according to claim **3**, wherein the locking tab or the chuck tab is provided

with a come-off preventive shape portion for preventing the locking tab or the chuck tab from coming off from the arm or the chuck.

8. The soft and thin resin molding device according to claim **7**, wherein the come-off preventive shape portion is formed of a cylindrical thick-walled portion, and the cylindrical thick-walled portion extends in the mold-withdrawing direction.

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